US010118562B2

(12) **United States Patent**
Gutierrez Gaspar et al.

(10) **Patent No.: US 10,118,562 B2**
(45) **Date of Patent: Nov. 6, 2018**

(54) **AUTOMATIC SLIDING ROOF RAIL SYSTEM**

(71) Applicant: **FORD GLOBAL TECHNOLOGIES, LLC**, Dearborn, MI (US)

(72) Inventors: **Jose Humberto Gutierrez Gaspar**, Naucalpan de Juarez (MX); **Jesus Alejandro Pena Casimiro**, Naucalpan (MX); **Juan Pablo Rios Rendon**, Mexico City (MX); **Gabriel Yaokoatl Horta Hernandez**, Cuautitlan (MX); **Norberto Mondragon Hernandez**, Mexico City (MX)

(73) Assignee: **Ford Global Technologies, LLC**, Dearborn, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 7 days.

(21) Appl. No.: **15/202,036**

(22) Filed: **Jul. 5, 2016**

(65) **Prior Publication Data**

US 2018/0009389 A1 Jan. 11, 2018

(51) **Int. Cl.**

B60R 9/045	(2006.01)
B62D 25/04	(2006.01)
B62D 25/06	(2006.01)

(52) **U.S. Cl.**
CPC ***B60R 9/045*** (2013.01); ***B62D 25/04*** (2013.01); ***B62D 25/06*** (2013.01)

(58) **Field of Classification Search**
CPC B60R 9/045; B62D 25/06; B62D 25/04
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,029,873	A	2/2000	Won et al.	
2003/0141735	A1	7/2003	Albaisa et al.	
2004/0195866	A1	10/2004	Fin	
2008/0272624	A1 *	11/2008	Donicke	B60R 9/045 296/216.01
2012/0074187	A1	3/2012	Gobart	
2012/0125961	A1	5/2012	Gobart	

FOREIGN PATENT DOCUMENTS

EP	1533186	A2	5/2005

OTHER PUBLICATIONS

English Machine Translation of EP1533186A2.

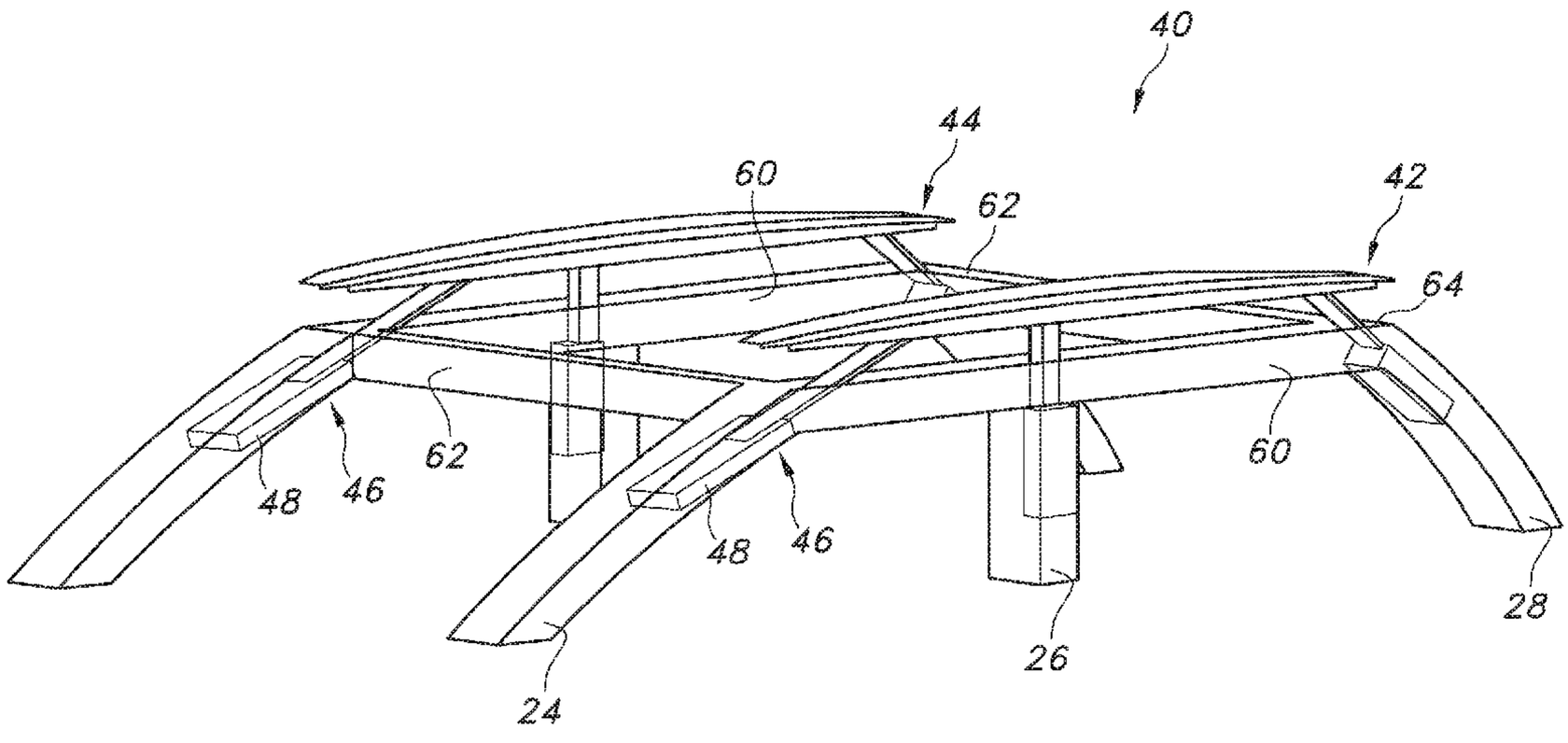
* cited by examiner

Primary Examiner — D Glenn Dayoan
Assistant Examiner — Melissa A Black
(74) *Attorney, Agent, or Firm* — Jason Rogers; King & Schickli, PLLC

(57) **ABSTRACT**

A system for providing storage on a vehicle roof is provided. The system comprises at least one partially hollow pillar for supporting the vehicle roof, a rail adapted to being raised and lowered relative to the vehicle roof between a deployed position for receiving cargo and a non-deployed position. An actuator is positioned at least partially along or within the at least one pillar for moving the rail relative to the roof. The actuator may comprise a pinion and a rack providing support for the rail. One or more supports may be connected to the rail for sliding as the rail is raised and lowered, including an active support for raising and lowering the rail in response to actuation. One or more passive supports for the rail may be slidably received in different pillars from the active support.

20 Claims, 6 Drawing Sheets



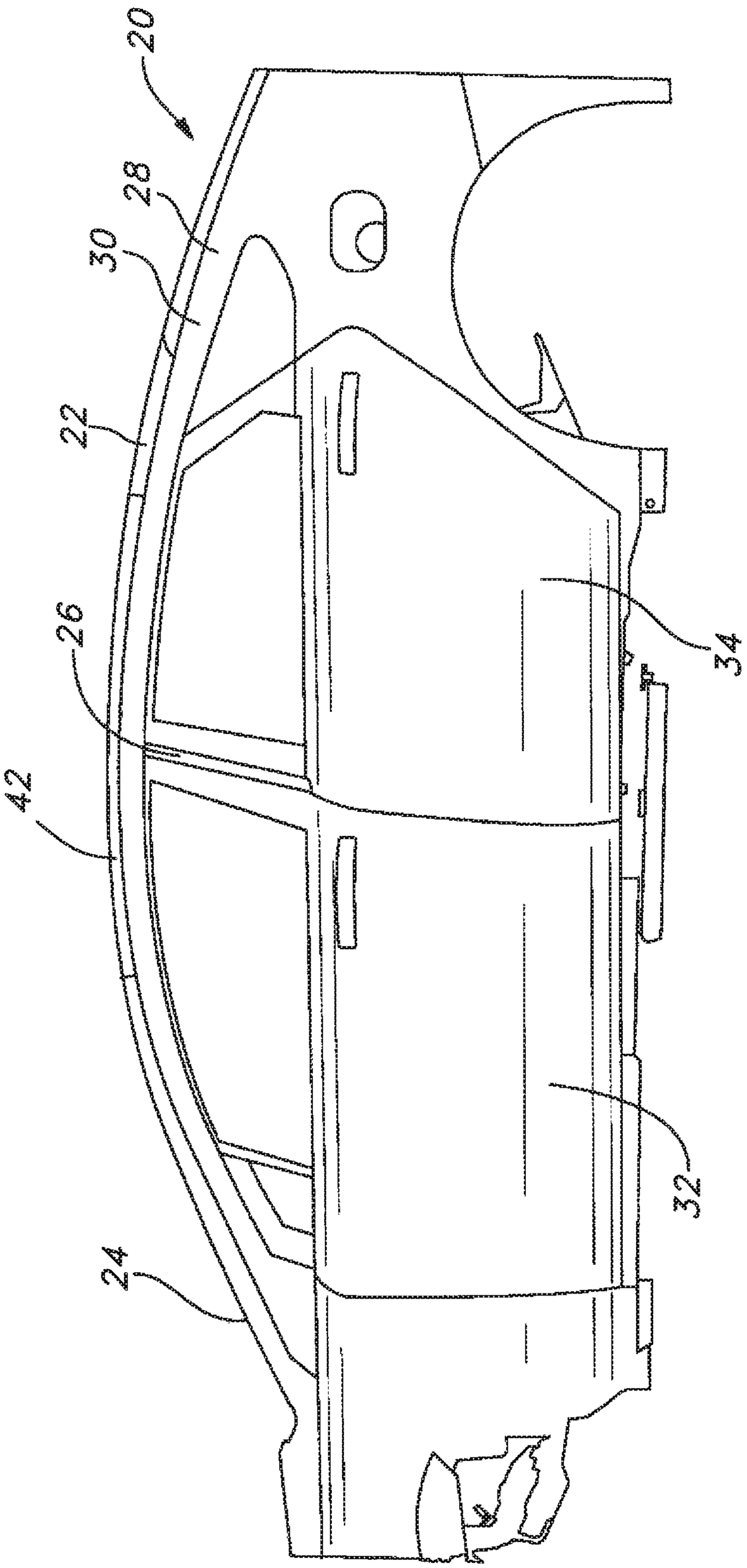


FIG. 1

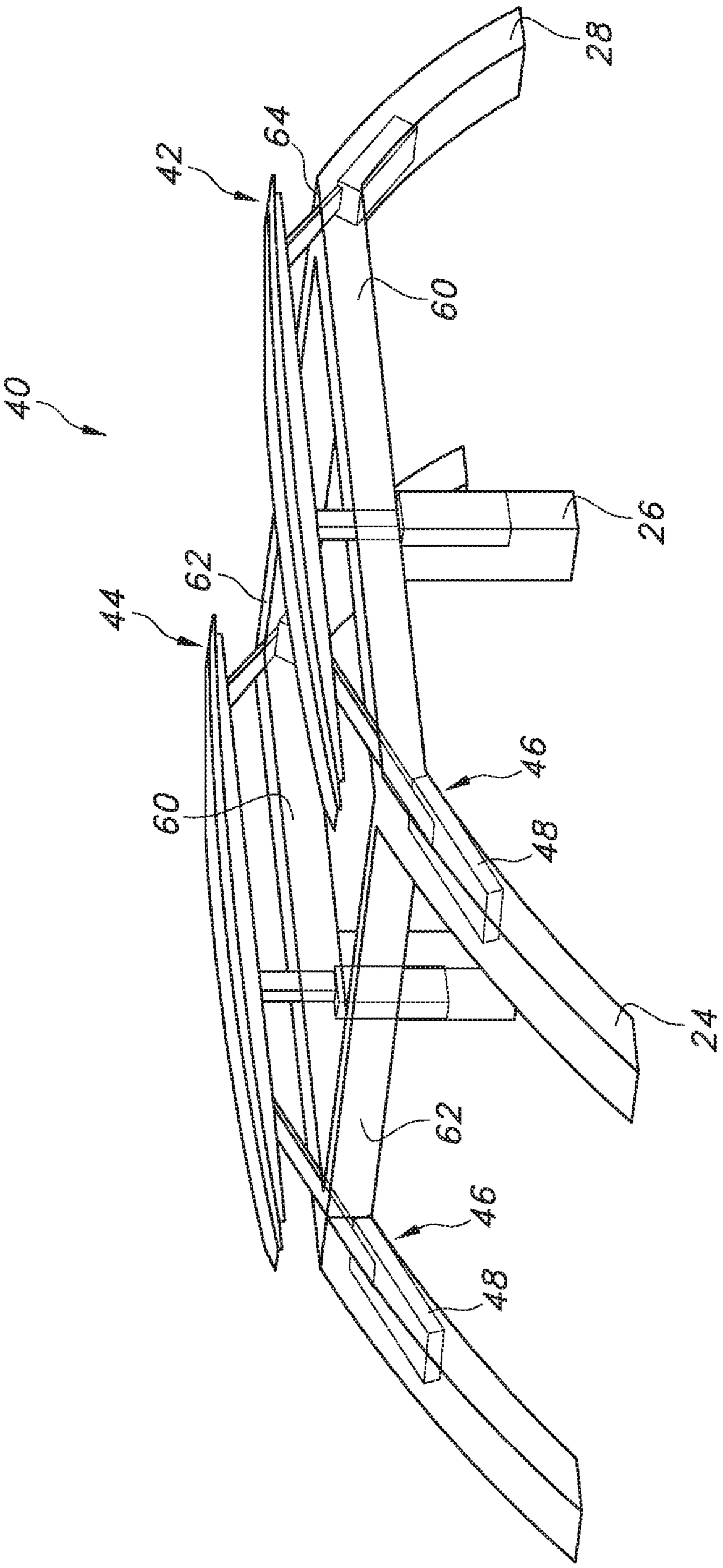


FIG. 2

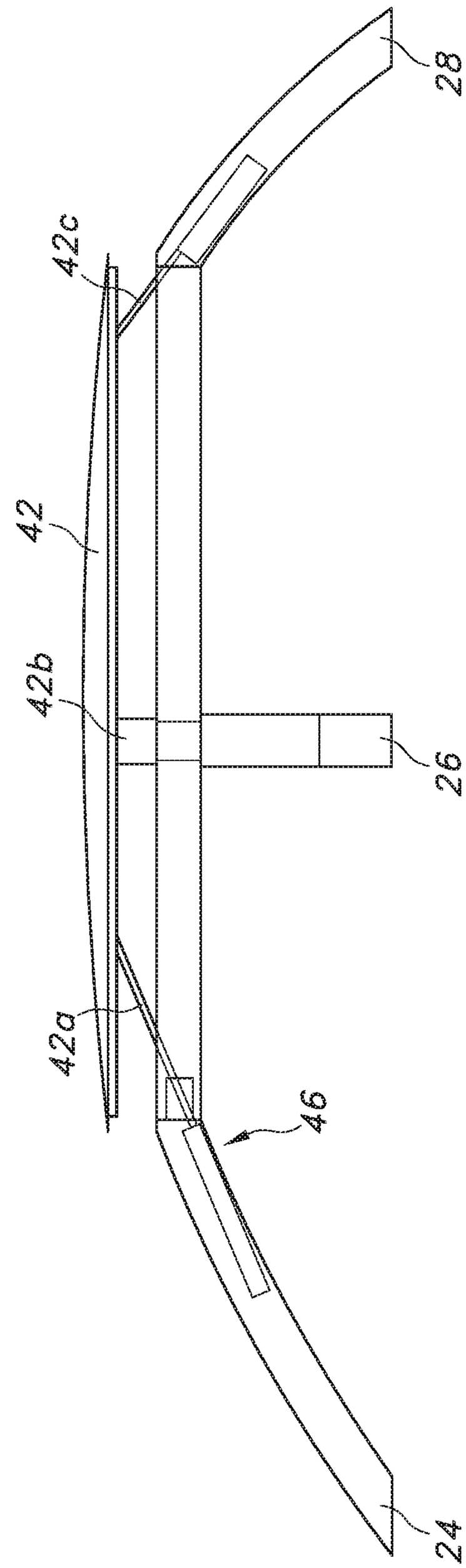


FIG. 3

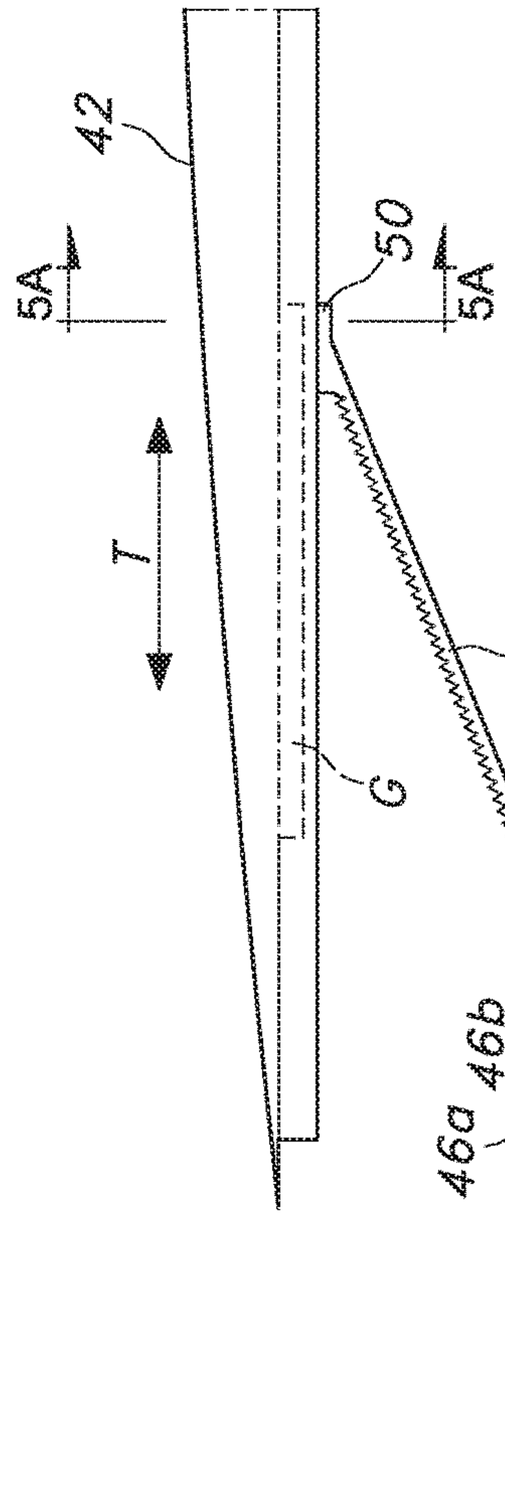


FIG. 5

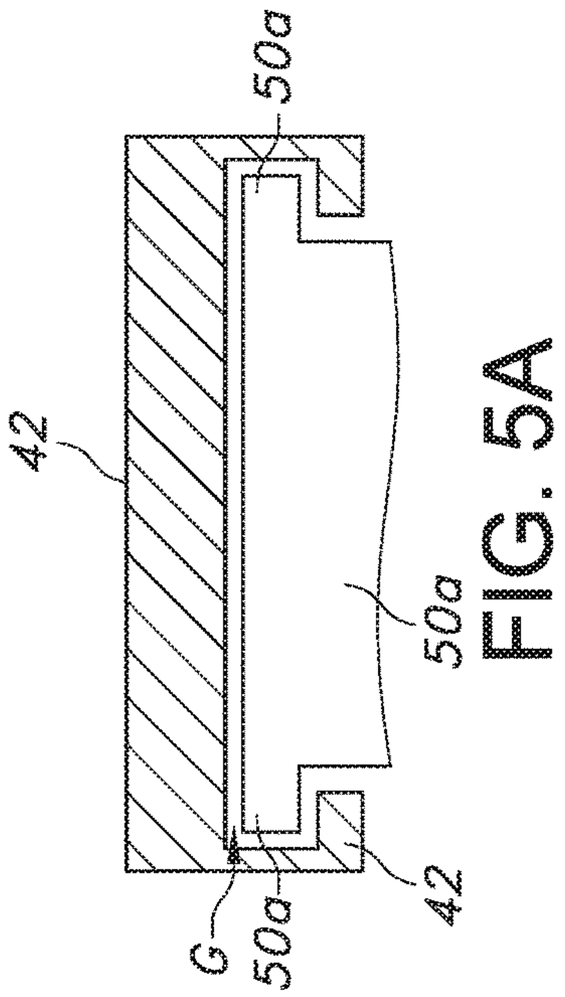


FIG. 5A

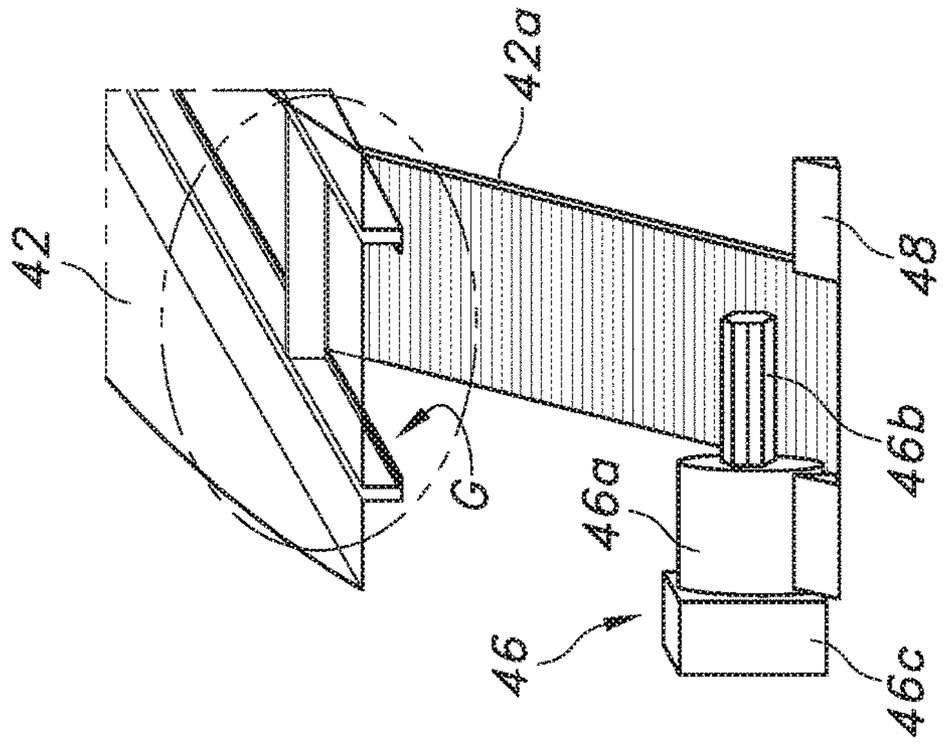


FIG. 4

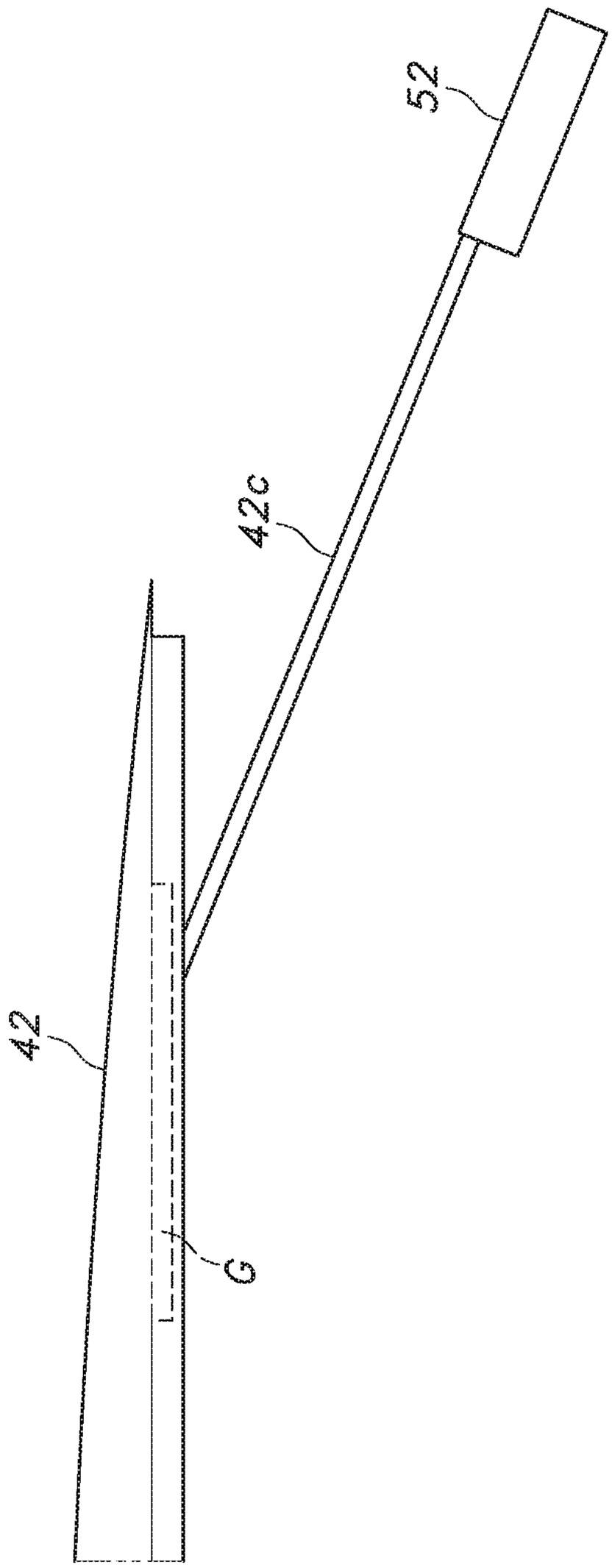


FIG. 6

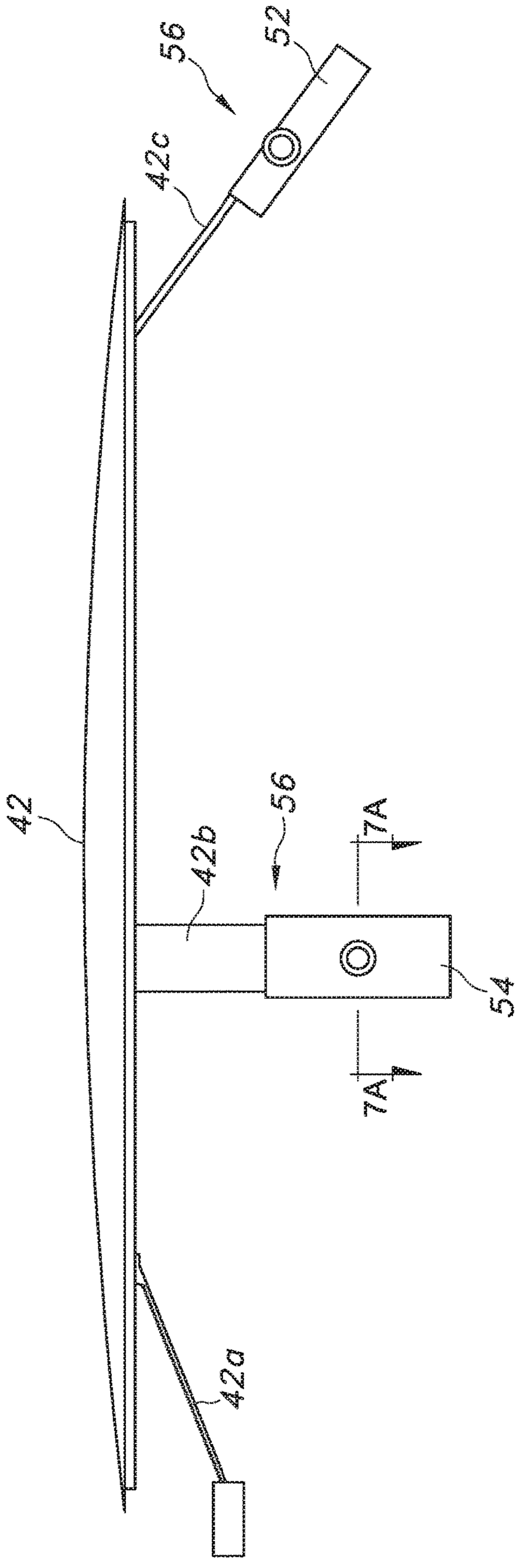


FIG. 7

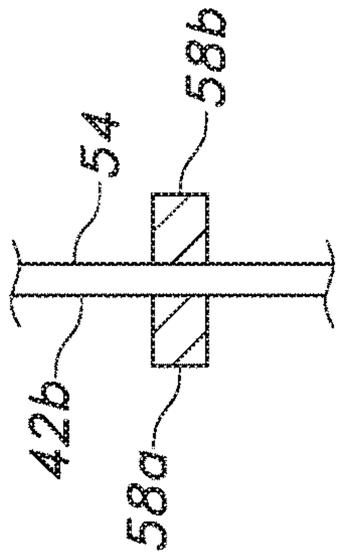


FIG. 7A

AUTOMATIC SLIDING ROOF RAIL SYSTEM

TECHNICAL FIELD

This document relates generally to the motor vehicle field and, more particularly, to an automatic sliding roof rail system.

BACKGROUND

Roof rail systems are often provided on motor vehicles to provide a convenient place for storing oversized or excess cargo that cannot be accommodated in other vehicle storage areas, such as the cabin or trunk. The roof rail is typically a fixed structure secured directly to the roof. This may create an obstruction in terms of the wind, which can lead to increased noise and reduced fuel efficiency, and may also have an undesirable impact on the aesthetics of the vehicle.

Accordingly, a need is identified for an improved automatic roof rail system that addresses the foregoing issues and perhaps others not yet contemplated.

SUMMARY

According to one aspect of the disclosure, a system for providing storage on a vehicle roof. The system includes at least one partially hollow pillar for supporting the vehicle roof. A rail is provided for raising and lowering relative to the vehicle roof between a deployed position and a non-deployed position. An actuator is positioned at least partially along or within the at least one pillar for moving the rail relative to the roof.

In one embodiment, the actuator comprises a support for the rail positioned at least partially within the at least one pillar. The at least one pillar may comprise an A-pillar. A second rail may also be provided for being raised and lowered relative to the vehicle roof, along with a second actuator for moving the second rail.

A first support may be slidably connected to the rail. The first support may be positioned in a C-pillar. A second support for the rail may be positioned in a B-pillar, and may be fixed to the rail between the support forming part of the actuator and the support positioned in the C-pillar.

The actuator may comprise a pinion and the rail may be connected to a rack in engagement with the pinion and positioned at least partially within the at least one pillar. A latch may also be provided for latching the rail in a raised position. The latch may comprise a magnetic coupling formed between a support for supporting the rail and another pillar for supporting the vehicle roof.

According to a further aspect of the disclosure, a system for providing storage on a vehicle roof is provided. The system comprises at least one pillar for supporting the vehicle roof, and a rail adapted to being raised and lowered relative to the roof. A support for the rail is received within the at least one pillar.

An actuator may also be provided for moving the rail relative to the roof. The actuator may be positioned at least partially within the at least one pillar. The system may also be arranged to work in connection with a plurality of pillars, with support for the rail associated with each of the plurality of pillars. The support may also be slidably connected to the rail.

Still a further aspect of the disclosure pertains to a system for providing storage for cargo. The system comprises a vehicle including a roof, and a rail adapted to being raised and lowered relative to the roof. A support for supporting the rail is connected to the rail for sliding as the rail is raised and lowered.

An actuator may also be connected to the support for moving the rail. A second support may be provided for supporting the rail for sliding as the rail is raised and lowered. Likewise, a third support may be provided, and may be fixed to the rail between the first and second supports. The roof may be supported by at least one pillar and at least partially received therein.

In the following description, several embodiments of an automatic sliding roof rail system. As it should be realized, the arrangement is capable of other, different embodiments and its several details are capable of modification in various, obvious aspects all without departing from the system as set forth and described in the following claims. Accordingly, the drawings and descriptions should be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

The accompanying drawing figures incorporated herein and forming a part of the specification, illustrate several aspects of the disclosed automatic sliding roof rail system serve to explain certain principles thereof. In the drawing figures:

FIG. **1** is a side view illustrating a vehicle including a plurality of pillars for supporting the roof;

FIG. **2** is a perspective view of an automatic sliding roof rail system;

FIG. **3** is a side view of the system of FIG. **2**;

FIG. **4** is a partially cutaway perspective view of an actuator for the system;

FIG. **5** is a partially cutaway side view illustrating the actuator and the sliding connection of the rail;

FIG. **5**A is a cross-sectional view along line **5**A-**5**A of FIG. **5**;

FIG. **6** is a partially cutaway side view further illustrating the sliding connection of the rail;

FIG. **7** illustrates the system with latches for holding the rail in the raised or deployed position; and

FIG. **7**A is a cross-sectional view along line **7**A-**7**A of FIG. **7**.

Reference will now be made in detail to the present preferred embodiments of the automatic sliding roof rail system, examples of which are illustrated in the accompanying drawing figures.

DETAILED DESCRIPTION

Reference is now made to FIG. **1**, which illustrates a vehicle **20** including a front or "A" pillar **24** for supporting and interfacing with adjacent structures, such as a windshield, a vehicle roof comprising a panel **22**, and doors **32**, **34** (which may also include windows). The vehicle **20** may also include a vertical or "B" pillar **26**, as well as a rear of "C" pillar **28**. Each pillar **24**, **26**, **28** may form portions of the vehicle body **30**. The pillars **24**, **26**, **28** may be generally hollow, tubular structures that extend generally upwardly in a vertical direction relative to the direction of vehicle travel, and connect with the panel **22** to provide support for it. The B-pillar **26** is the most vertical and is positioned between the doors **32**, **34**, while the A-pillar **24** and C-pillar **28** extend in a sloped manner toward the front and rear of the vehicle **20**, respectively.

The vehicle **20** may be provided with a selectively actuatable roof rail system **40**. In the illustrated embodiment, the system **40** includes a pair of spaced rails **42**, **44** adapted for moving between a lowered or non-deployed position (FIG. **1**) closer to the roof panel **22** and a raised or deployed position (FIG. **2**) spaced from the roof panel. As can be appreciated, the rails **42**, **44** in the non-deployed position create a lower profile for the vehicle **20**, and in the raised position may accommodate articles for storage on the roof panel **22** while the vehicle is traveling.

According to one aspect of the disclosure, the system **10** includes an actuator **46** that may be associated with one of the pillars **24**, **26**, **28**, such as by being positioned along or within it. In the illustrated embodiment, the actuator **46** is positioned at least partially within a recess or cavity in the front or A-pillar **24**, and includes an active support **42***a* for supporting the rail while moving it to and fro between the lowered/non-deployed and raised/deployed positions. The support **42***a* is at least partially received in a recess of the A-pillar. Actuation of the actuator **46** thus moves the support **42***a* and causes the rail **42** to move relative to the roof panel **22**.

In the particular embodiment shown, and with reference to FIGS. **2** and **3** together, it can be appreciated that the roof rail **42** also includes a second or intermediate support **42***b* engaging B-pillar **26**, as well as a third or rear support **42***c* engaging the C-pillar **28**. The arrangement may be such that the supports **42***b*, **42***c* are slidably received in recesses within the corresponding pillars **26**, **28**. Consequently, the supports **42***a*, **42***c* are free to move to and fro in a passive manner response to the actuation and lifting/lowering of the rail **42** by the actuator **46**.

Turning to FIGS. **4** and **5**, a particular embodiment of an actuator **46** is shown in the form of a rack and pinion arrangement. Specifically, the support **42***a* is provided with teeth (thus forming a rack) for engaging a gear or pinion **46***b* rotated by a motor **46***a* forming part of actuator, which may be connected to a stable support **46***c*. The support **42***a* may thus be considered to form a part of the actuator **46**. A guide **48** may also be provided within the pillar, such as A-pillar **26**, for guiding the support **42***a* in a sliding fashion. Consequently, rotation of the motor **46***a* in opposite directions causes the support **42***a* to slide to and fro in a travel direction T relative to the guide **48** for raising and lowering the associated rail **42**. The use of a rack and pinion arrangement also ensures that the rail **42** remains reliably secured in the deployed position despite the weight of cargo on the rail, since the motor **46***a* when stopped would prevent the pinion **46***b* from rotating, and thus serves as a holder to maintain the security of the system **10**.

As also shown in FIG. **5**, the first or front support **42***a* may optionally be connected to the rail **42** for relative sliding movement. Specifically, perhaps best understood with reference to the cross-sectional view of FIG. **5**A, the support **42***a* may include a connector **50** for slidably connecting to the rail **42**. In the particular embodiment, the connector **50** includes outwardly projecting pins **50***a* that interface with a groove G formed in the interior of the rail **42**. Consequently, as the forward support **42***a* is raised and lowered, the connector **50** slides along the rail **42**, thus allowing for selective control of the raised height (and the time it takes to reach the maximum height) as a function of the actuation.

As indicated in FIG. **6**, a similar arrangement may also be provided at the rear support **42***c* associated with the C-pillar **28**. The C-pillar **28** may also include a guide **52** for receiving, supporting, and guiding the depending support **42***c* during the activation and de-activation of the rail **42**, such as in a sliding fashion. A guide **54** may also be provided for the support **42***b* associated with the B-pillar **28**, but the sliding feature is not necessary since the movement is essentially in the vertical direction V.

FIGS. **7** and **7**A also illustrate the option of including one or more latches **56** for latching the rail **42** to the vehicle **20** and one or more of the pillars **24**, **26**, **28** in particular. In one embodiment, the latch **56** comprises a magnetic coupling formed between one or more of the supports **42***b*, **42***c* and the corresponding pillar **26**, **28** (or the associated guide **52**, **54**). The coupling may be established between opposed (in orientation and polarity) magnets **56***a*, **56***b* that connect when the rail **42** is raised, which should be sufficiently robust to allow for support of any articles or objects stored by the rack. Either the automatic lowering or manual force may then be used to disconnect the rail **42** and return it to the non-deployed position.

The actuator **46** is shown in the A-pillar **24**, which advantageously is proximate to the vehicle battery at the typical location in an engine compartment of the vehicle **20**, but it could be associated with the B-pillar **26** or the C-pillar **28** instead with suitable wiring to the battery (which can sometimes be located at the rear of the vehicle **20**, such as in the trunk). The actuator **46** may also take different forms, such as a linear actuator, and/or may be pneumatic instead of mechanical. Multiple actuators may also be provided for each rail **42**, **44**.

While the foregoing discussion centered on one rail **42**, it should be appreciated the same or a similar configuration could be used on the second rail **44**, or perhaps even additional rails, as indicated by the depiction of actuator **46** of the left hand side of FIG. **2**. The rails **42**, **44** may also form part of a cargo rack (not shown) that includes sidewalls and end walls for receiving cargo. The particular form or shape of the rails **42**, **44** is not considered important.

The rails **42**, **44** may also be recessed relative to the roof panel **22** in the non-deployed position. Specifically, with reference back to FIG. **1**, a channel **60** may be provided for receiving a support portion of each rail **42**, **44**. The channels **60** may connect with the pillars **24**, **26**, **28**, and transverse members **62** may form connections to create a framework for supporting the roof panel **22**. A seal **64** may also be provided for sealing the corresponding interface from the ingress of moisture when the rail **42** is stowed within the channel **60**. The upper portions or faces of the rails **42**, **44** may also be contoured for matching the profile of the roof panel **22**, so that in a flush condition, a substantially continuous appearance is provided (see, e.g., FIG. **1**).

Actuation of the system **10** to deploy the rail(s) **42**, **44** may be achieved using a control (not shown) within the vehicle **20**, such as on a control panel. Alternatively or additionally, the control may be achieved by a remote device, such as a portable or handheld mobile computer or a key fob (not shown). In any case, the system **10** may be selectively activated by the user when cargo storage on the vehicle roof is desired, and de-activated when this functionality is not needed.

In summary, an automatic sliding roof rail system **10** is provided that can be selectively deployed by a vehicle operator when it is desirable to store cargo on a vehicle roof. The system **10** includes an actuator **46** for moving a rail **42** (or rail **44**) recessed in one (or more) of the pillars **24**, **26**, **28** for supporting the vehicle roof (panel **22**), which creates a low profile arrangement. The rail **42** may also be slidably connected to one or more supports **42***a*, **42***c* to allow for regulation of the height as a function of the actuation. Latches **56** may also be provided for holding the rail **42** in

the deployed or raised condition, such as along depending portions **42***b*, **42***c* of the rail that are not associated with actuator **46**. A selectively actuatable system **10** thus results that is reliable and secure in operation.

The foregoing description of an automatic sliding roof rail system has been presented for purposes of illustration. It is not intended to be exhaustive or to limit the embodiments to the precise form disclosed. Obvious modifications and variations are possible in light of the above teachings. For instance, in a vehicle **20** without three pillars, as shown, one of the supports (such as support **42***b* if no B-pillar **26** is present) may be omitted. The supports or actuator may also extend along an outer surface of the pillar, such as adjacent to the vehicle cabin, with the pillars thus providing support and guidance in the same manner as if the support were recessed within a hollow portion of the pillar. All such modifications and variations are within the scope of the appended claims when interpreted in accordance with the breadth to which they are fairly, legally and equitably entitled.

What is claimed:

1. A system for providing cargo storage on a vehicle roof, comprising:

a tubular pillar for supporting the vehicle roof;

a rail adapted for raising and lowering relative to the vehicle roof between a deployed position for receiving cargo and a non-deployed position; and

an actuator positioned at least partially along the tubular pillar for moving the rail relative to the vehicle roof.

2. The system of claim **1**, wherein the actuator comprises a support for the rail, the support being positioned at least partially within the tubular pillar and projecting vertically therefrom in the deployed position of the rail.

3. The system of claim **2**, wherein the at least one pillar comprises an A-pillar.

4. The system of claim **1**, further including a second rail adapted for being raised and lowered relative to the vehicle roof, and further including a second actuator for moving the second rail relative to the vehicle roof.

5. The system of claim **1**, wherein a first support for the rail is slidably connected to the rail.

6. The system of claim **5**, wherein the first support is positioned in a C-pillar.

7. The system of claim **6**, wherein a second support for the rail is positioned in a B-pillar.

8. The system of claim **1**, wherein the actuator comprises a pinion and the rail is connected to a rack in engagement with the pinion, the rack positioned at least partially within the at least one pillar.

9. The system of claim **1**, further including a latch for latching the rail in the deployed position.

10. The system of claim **9**, wherein the latch comprises a magnetic coupling formed between a support for supporting the rail and another pillar for supporting the vehicle roof.

11. A system for providing cargo storage on a vehicle roof, comprising:

an A-pillar for supporting the vehicle roof;

a rail adapted for being raised and lowered relative to the vehicle roof between a deployed position for receiving cargo and a non-deployed position; and

a support for the rail received within the A-pillar.

12. The system of claim **11**, further including an actuator for moving the rail relative to the vehicle roof.

13. The system of claim **12**, wherein the actuator is positioned at least partially within the A-pillar.

14. The system of claim **11**, further including a plurality of pillars, and wherein a support for the rail is associated with each of the plurality of pillars.

15. The system of claim **11**, wherein the support is slidably connected to the rail for moving to and fro as the rail moves between the deployed and non-deployed positions.

16. A system for providing storage for cargo, comprising:

a vehicle including a roof;

a rail adapted to being raised and lowered relative to the roof between a deployed position for receiving cargo and a non-deployed position; and

a first support for supporting the rail, the first support connected to the rail for sliding along the rail when the rail is raised and lowered.

17. The system of claim **16**, further including an actuator connected to the first support for moving the rail.

18. The system of claim **16**, further including a second support for supporting the rail, the second support slidably connected for moving along the rail in moving between the deployed and non-deployed positions.

19. The system of claim **18**, further including a third support for supporting the rail, the third support being fixed to the rail between the first and second supports and positioned at least partially within a B-pillar of the vehicle.

20. The system of claim **16**, wherein the roof is supported by at least one pillar, the first support at least partially received within the pillar and extending therefrom in the deployed position of the rail.

* * * * *